THE CRUSHED STONE JOURNAL

Official Publication
The National Crushed Stone Association

In This Issue—

NOVEMBER, 1930

WHY HAVE LOSSES

Poor Grading—High Overhead—Troubles

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Rock-Cut Stone Company	Bailina, Madison Co., N. Y.
Rock-Cut Stone Company	Jamesville, N. Y.
Rock-Cut Stone Company	Lacora, N. Y.
Rock-Cut Stone Company	Watertown, N. Y.
Mohawk Limestone Products Company	Mohawk, N. Y.
Mohawk Limestone Products Company	Jordanville, N. Y.
Mohawk Limestone Products Company	Mount Vision, N. Y.
BUFFALO Crushed Stone Company	Buffalo, N. Y.
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National Lime & Stone Co.	Carey, Ohio
National Lime & Stone Co.	Lewisburg, Ohio
National Lime & Stone Co.	Bluffton, Ohio
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Higgins Stone Company	Bellevue, Ohio
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Lake Erie Limestone Company	Lowellville, Ohio
Lake Erie Limestone Company	Hillsville, Pa.
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Spencer Stone Company	Spencerville, Ohio
Union Limestone Company	Youngstown, Ohio
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France Stone Company	Monroe, Mich.
Swint Stone Company	Fremont, Ohio
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J. E. Baker Company	White Hall, Baltimore, Md.
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New Castle Lime & Stone Company	Dunbar, Pa.
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Stowe Trap Rock Company	Pottstown, Pa.
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Blue Stone Quarry Company	Gwynedd Valley, Pa.
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New Haven Trap Rock Company	New Haven, Conn.
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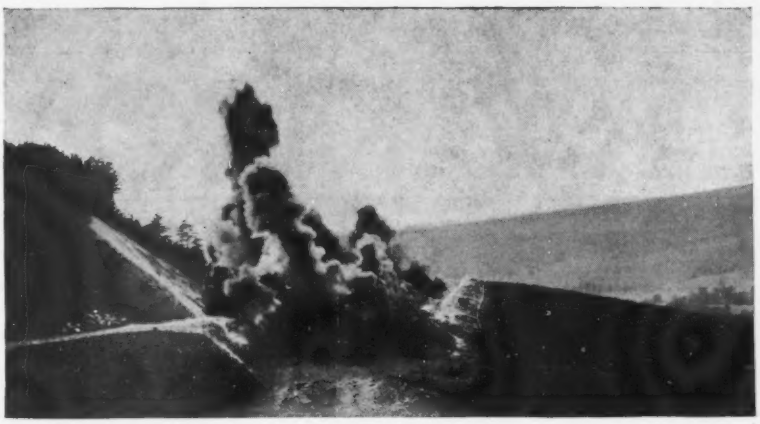

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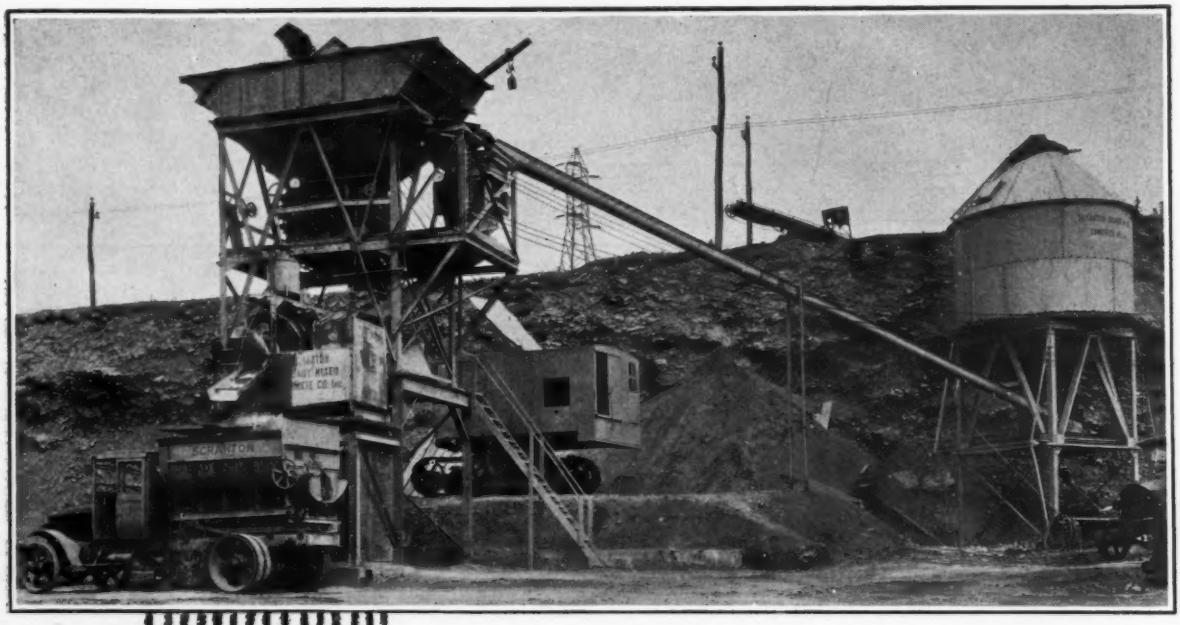

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Laboratory Studies in the Prevention of Segregation

By A. T. GOLDBECK, *Director,*

Bureau of Engineering, National Crushed Stone Association

NO doubt almost every crushed stone producer in the country at some time has had cars of stone rejected because of alleged failure to meet the requirements for gradation. Such rejections have happened notwithstanding the fact that the producer apparently has made a sincere effort to size the stone according to the specifications. Mechanical analyses of samples taken from the cars have shown that these particular samples did not comply with the specifications and consequently it was assumed by the inspector that the entire car was poorly graded in size. This, of course, may have been the true state of affairs, but, on the other hand, in many cases of this kind had it been feasible to use the entire car as the test sample the chances are very strong that the stone would have been found to comply with the gradation requirements. The fact is that in spite of proper screening and correct proportioning of the various sizes of aggregates, the material became segregated, either in the producer's bin or in the railroad car during the loading operation.

It is difficult, if not almost impossible, to sample a car of badly segregated stone in such a way that the sample truly represents the average of the car. This fact is not generally recognized by inspectors and consequently whenever stone is loaded into a car in a manner which results in segregation, that car is in danger of rejection.

In view of this difficulty of proper sampling and because of the great expense which it entails on the manufacturer due to the rejection of his material and to the resultant piling up of demurrage charges, the value of a simple and inexpensive means for preventing segregation is obvious. A study of the phenomenon of segregation therefore seems to be well warranted and as a preliminary step in this direction, laboratory investigations have been started in the laboratories of the National Crushed Stone Association.

Theory of Segregation

It will be well at the outset to stop and consider the phenomenon which causes segregation of graded stone when it is handled from one place to another. The usual practice in most stone plants in loading bins or cars is to allow the stone to fall in a single stream, whether it be into the concrete aggregate bin, or from the bin into the car waiting to be loaded. When stone falls in a single stream it piles up in the form of a cone and invariably it will be found that the material in the outside of the cone is composed of the largest size fragments and in the center of the cone there will be found a zone in which are contained most of the finer size particles. The reason for this segregation is not difficult to understand. As the stone falls in a pile it develops surface voids which tend to entrap the remaining stone in the falling stream. If the diameter of the stone particles is smaller than the diameter of the voids in the surface of the pile, very naturally these small particles, instead of rolling down the pile will be caught in the voids and will remain there. On the other hand, if the diameter of the particles is larger than the diameter of the voids in the surface of the cone, they will continue to roll until they are caught in the larger size voids further down the pile or they are stopped by stones projecting above the surface of the pile. This explains why the larger stones are found on the outside of the pile and the smaller stones are in the central portion. If this explanation is correct,

it follows that if the stone could be distributed over the surface of the car, or over the surface of the bin, during the loading operation in a manner which will prevent the formation of a conical pile, segregation would be largely overcome. To test the validity of this theory a series of laboratory investigations was started.

Laboratory Studies of Segregation

Obviously, in the laboratory it is impossible to handle large stockpiles of stone. But on the other hand, it is feasible to work with stone of small dimensions using a small stockpile. The same reasoning with regard to segregation holds no matter what may be the size of the stone. For illustration, if stone screenings are used extending up to ¼ inch in size, the ¼ inch particles will act in the same manner as the large size fragments in coarse aggregate and the dust portion of the screenings will act in the same manner as the ¼ inch to ⅜ inch particles in the full size aggregate. Thus, if screenings are allowed to fall from a given height in a single stream and are allowed to pile up in the form of a cone, the dust will be found located within the central portion of that cone and the larger particles of the screenings will roll to the outside of the cone. The behavior is exactly the same as in the case of the large size concrete aggregate. This fact permits of making an investigation in the laboratory, in a preliminary way at least, so that light may be thrown on methods which may be employed to obviate the difficulty of segregation.

For the purpose of the laboratory investigation a model bin and also a box simulating a railroad car were constructed to a scale of one inch to the foot and the height of the spout in the bottom of the bin was regulated to the correct vertical scale. The screenings used were passed through a No. 4 sieve, (0.187 in. opening) and were retained on a No. 50 sieve (0.0117 in. opening). This maximum size is about 1/12 of the 2¼ inch square opening maximum size stone used in concrete aggregate for highway construction. The smallest size particles passing through the No. 50 sieve, correspond closely with the full size stone which would pass through the No. 4 to No. 8 laboratory sieve. That is to say, the sample of screenings used in the laboratory investigations was approximately on the scale of one inch to the foot as compared with the actual size coarse aggregate used in concrete highway construction.

Keeping the above stated theory of segregation in mind, efforts were devoted to an attempt to prevent the piling up of the material in the form of a cone. Various schemes immediately suggest themselves as means for properly spreading the stone over the car so that cone piling will be prevented, partially, if not entirely. For illustration, the thought occurs that if the single stream running out of the spout at the bottom of a bin could be divided into two streams, then, instead of having a single cone pile up at the bottom of the car, two cones would form each with its central core of fine material and thus segregation would be prevented in part. The fine particles have thus been distributed to a greater extent at least than with the usual method of loading. Any means which will divide the single stream into two streams will accomplish this purpose. The following possible methods of preventing segregation were investigated:

No. 1, Fig. 1. A cone was suspended under the stream by means of a flexible cable. This scheme did not work for the reason that the stream in falling out of the spout simply deflected the cone to one side and consequently the stone fell in a single stream and piled up in the form of a cone as usual.

No. 2, Fig. 2. The cone was suspended in a fixed position under the stream. In this case the stone piled up in a ring, the large material rolling toward the center of the ring and also to the outside. The fine material was found in the axis of the ring.

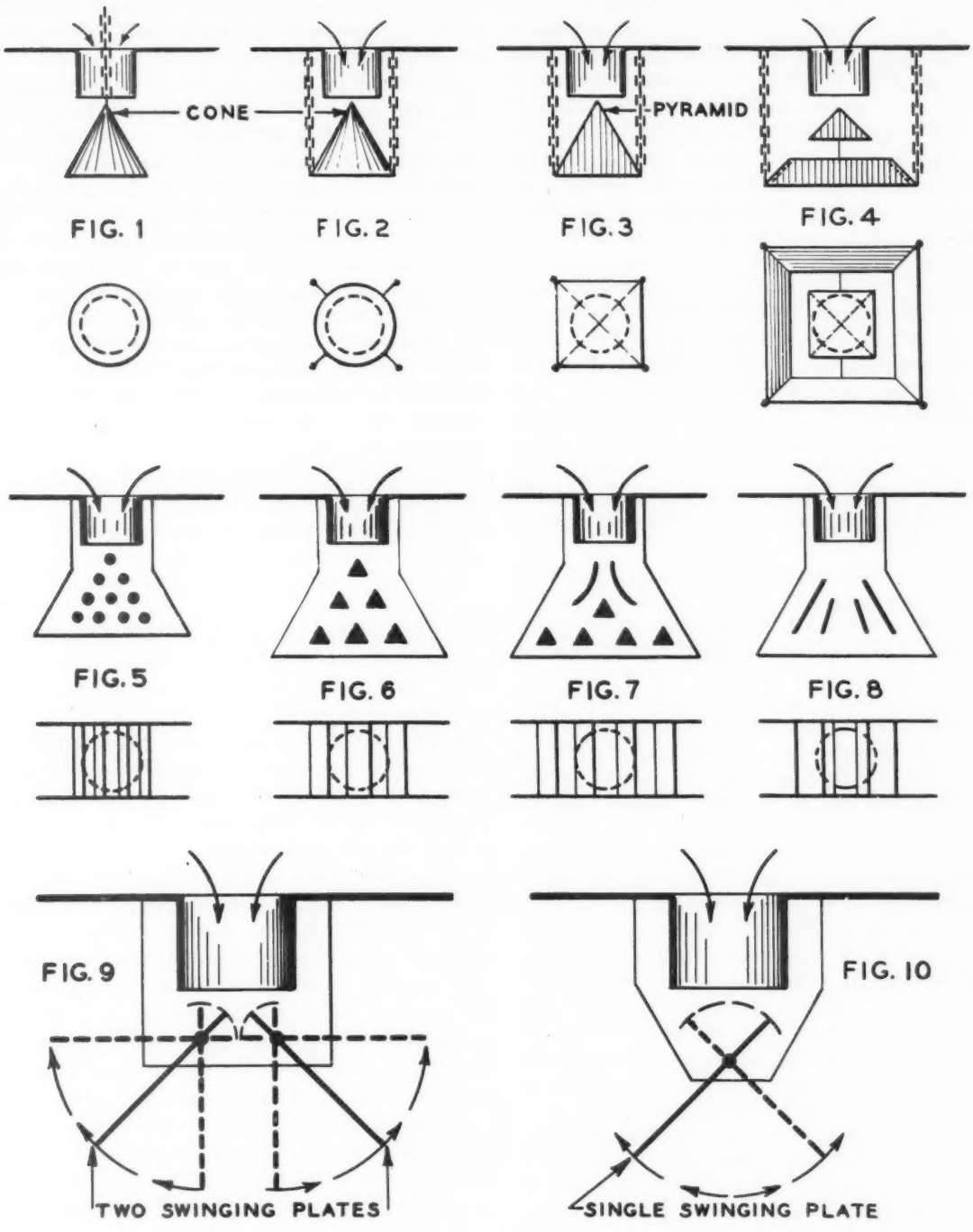
No. 3, Fig. 3. A rectangular pyramid was suspended in a fixed position under the center of the stream and the results were similar to those obtained with No. 2 in which a cone was used.

No. 4, Fig. 4. This was a modification of No. 3. It consisted of a rectangular pyramid and under it a hollow truncated pyramid as illustrated. This scheme did not work; it caused segregation by throwing the coarse material to the outside and deflected the fine material to the inside.

In method No. 5, Fig. 5, a grid was used to determine the possibility of deflecting the stream sufficiently so as to distribute it over the car in a lateral direction. This had an action similar to screening. The large material, however, rolled to the outside and the fine material simply trickled through and piled up on the inside, thus segregating it as usual.

No. 6, Fig. 6, consisted of a grid, making use of larger wedge-shaped wedges than used in No. 5, the idea being to deflect the stone and distribute it laterally over the car. This method, however, was entirely unsuccessful and again resulted in serious segregation.

In No. 7, Fig. 7, a combination of a grid and curved plate was used, the idea being that the plate would



Various Devices Used in the Study of Prevention of Segregation

deflect a portion of the stream to the outside and the grid would serve as a means for distributing the stone over the car in a lateral direction. The chute was somewhat successful in delivering the fines to the outside of the car and this method promises some success.

In No. 8, Fig. 8, a combination of adjustable chutes was used. The chutes consist simply of plates which may be adjusted in their positions both laterally and with regard to their angle of inclination. This method distributed the stone evenly across the car so that it piled up in five piles whose effect practically is that of piling the stone in a horizontal layer across the car. Segregation with this method was almost eliminated.

It was quite outstanding that if a means is used which will spread the stone evenly across the car and pile it up in a horizontal line during the progress of loading, segregation, in a lateral direction at least, will be prevented. The necessity of adjusting the plates in Method No. 8 to get the proper angle and spacing for the different size material and the complication thus introduced seemed to render this scheme impractical for actual use.

Method No. 9, Fig. 9, consisted of two plates suspended under the spout at a point perhaps a third of the way down from the top of the plate. The object of suspending the plates at this position rather than at the top of each plate is to make it easier to move them from side to side. During the operation of loading the car, the plates are moved simultaneously in opposite directions from side to side; thus the stream of stone is thrown from one side of the car to the other and the top of the pile is always kept horizontal. Coning of the material is thereby prevented and it is found that the fine material is distributed practically as much as the coarse material. By this means segregation is prevented in a lateral direction.

In method No. 10, Fig. 10, a single plate is pivoted under the center of the stream at a point one-third of the way down from the top of the plate. During the operation of loading the car this plate is simply swung from side to side and the stream of stone is deflected over the width of the car and thus segregation is prevented in a lateral direction. The fine stone seems to be distributed just as well as the coarse stone.

For the purpose of determining the efficiency of the various methods tried for preventing segregation samples were taken from the two outside portions of the car and also from the central portion and a mechanical analysis was made of these specimens. The result of these mechanical analyses are shown in the following Table I. The more closely the mechanical analyses of the samples taken from the outside of the car agree with those from the inside, the more nearly has segregation been prevented.

In Series I no appliance whatever was used to prevent segregation. The material merely fell from the spout in the bottom of the bin down into the car in the form of a cone, as is usual in loading cars. The analysis of the sample from the car does not quite agree with that of the original material but this would not be expected since there is some segregation in the bin itself. It will be noted that in Series I considerable segregation has taken place for the analyses of the inner and outer portion do not agree as they should had the material been uniformly distributed across the car. It will be observed that there is more coarse material on the outside and more fine material on the inside of the car as is usual in full size cars loaded in this manner.

In Series II where a single balanced gate was used (Method No. 10) the different sizes are quite uniformly distributed over the width of the car as shown by the fair agreement of the analyses of the inner and outer samples and the small differences between these analyses.

In Series III, Method 9, employing two balanced gates, the distribution is even better than in Method 10 as shown by the more exact agreement of the mechanical analyses.

When the single balance gate was used the differences in the mechanical analyses were somewhat greater than where two movable gates were used, showing that the single method is not quite as efficient as the two gate method. In the two gate method it is important that these gates be adjusted to their proper spacing and no doubt this spacing will differ with different sizes of stone. Because of its simplicity the single balance gate recommends itself.

Thus far no other means for preventing segregation have been tried in the laboratory. Of course, there are other means which have been tried in practice. For instance, it is known that a flexible spout composed of a series of segments in the form of jointed frustrums of a cone is highly successful in that it may be swung to all positions in the car and the stone is deposited wherever desired without danger of rolling.

Still another method is that devised by Mr. W. S. Weston of the Weston & Brooker Company of Columbia, S. C. This device has been very well described by W. H. Mills, State Testing Engineer, in an

article entitled, "Shuttle Loader for Cars—Reduces Segregation of Crushed Stone" which appeared in the July, 1930, issue of *Construction Methods.*

No doubt still other methods may be devised for preventing segregation of stone, not only in the loading of cars but also in the loading of bins. The expense of these simple means for preventing segregation is practically negligible and it would seem that the slight expense involved would be repaid many fold through the prevention of trouble from the rejection of cars.

Thus far no attempt has been made to prevent segregation in the direction of the axis of the car. This can be accomplished by keeping the car in motion or at least by moving it frequenty during the loading operation. Possibly, however, other means may be devised for this purpose.

Unfortunately an inconsistent attitude is too frequently taken by many state highway departments in their consideration of the matter of segregation of aggregates. The same department which is rigid in rejecting a car because the stone has segregated will permit the contractor to unload the car with a clamshell and stockpile the stone in such a way that it forms a cone, the very best way of causing segregation.

The gradation of crushed stone will be utterly ruined by continuously dumping it at a single spot thus building up a conical stockpile. Stockpiles should be made by piling the stone in horizontal layers not exceeding four feet in thickness. In this way, to a very large extent, the large stone will be prevented from rolling down to the outside of the pile.

It is the intention to carry the laboratory studies of preventing segregation further and, later, studies will be made at a producing plant to work out the details of a scheme for preventing segregation which seems best adapted for the purpose.

TABLE I—MECHANICAL ANALYSES TO DETERMINE SEGREGATION

Original Gradation of Material Placed in Bin

No. 4 – No. 8	50%	No. 16 – No. 30	12.5%
No. 8 – No. 16	25%	No. 30 – No. 50	12.5%

Size of Screen	Entire sample from Car	Inner Portion	Outer Portion	Differences (should be zero with no segregation)
Series I—No Device Used to Prevent Segregation				
4 – 8	49.5	41	58.5	17.5
8 – 16	25.5	26	25	1
16 – 30	11.5	14	8.5	5.5
30 – 50	13.5	19	8	11
Series II—Single Balanced Gate				
4 – 8	48.5	46	50	4
8 – 16	26	26.5	25	1.5
16 – 30	12	12.5	12	0.5
30 – 50	14	14	13	1.0
Series III—Double Balanced Gate				
4 – 8	49.5	50.5	49	1.5
8 – 16	26	25	26	1.0
16 – 30	11.5	11.5	11.5	0.0
30 – 50	13	13	13.5	0.5

Program For St. Louis Convention Nears Completion

THE program of the Fourteenth Annual Convention of the crushed stone industry is now practically completed and is given in full detail on the pages immediately following this article. This program has been formulated only after months of serious and thoughtful consideration and much arduous work. Every crushed stone producer of the United States and Canada should carefully study it for we feel that no more convincing argument in behalf of attendance at the St. Louis meeting can be offered than the knowledge that during the three and one-half days of the convention all of the more important problems affecting the welfare of the industry will be discussed in an interesting and instructive manner by leading authorities on the various subjects.

MAYOR VICTOR J. MILLER

The following include some of the subjects which will be presented and discussed and in which every crushed stone producer has a most vital interest: The Economic Features of the Bituminous Type of Road; Taxation and Transportation; The Applicability of Various Methods for Sewage Disposal; Rates and Rate Making; What is the Construction Outlook?; Ready-Mixed Concrete; Researches in the Durability of Concrete; Researches of the National Crushed Stone Association; Responsibility of the Aggregate Producer as Viewed by the Engineer; What Factors Control the Service Value of Ballast; The Control of Accidents; The Secondary Road Problem. Of equal interest but from a different point of view will be found the following: How to Win an Argument; Popularizing an Industry; Mental Self Discipline Aids in Industry.

PROF. A. C. BUSSE

The salesmen who are present will be more than repaid by the valuable information which such talks as the following will yield: Development and Carrying Out of a Sales Program Through Central Office Control; The Management of Credit in the Stone Industry; What Can a Local Trade Association Do to Ethically Promote Sales? And the operating men, superintendents and manufacturers will find these papers of especial interest: Crusher Bearings, Their Troubles and Remedies; The Prevention of Segregation and Breakage in Bins; The Use of Electricity in the Handling of Stone. In addition to all of the foregoing, many of the standing committees of the Association will present reports representing the work accomplished throughout the past year, which show real progress towards the solution of their respective problems. Taking it all in all, we believe the program will be found to be well-rounded and sufficiently diversified in its character to offer much of interest and value to everyone present and to include an exceptional list of speakers who are particularly well equipped to present their subjects. At no other time throughout the year can you hope to receive so much for the expenditure of so little as by attending the annual business meeting of your industry. By all means let nothing prevent your being present at St. Louis. We wish every crushed stone producer of the United States and Canada, regardless of whether they are members of the National Crushed Stone Association, to be present and participate to the fullest extent in the various activities and discussions of the convention. We repeat that a careful

J. V. NEUBERT

ROBERT J. KRATKY

study and analysis of the program will quickly convince you of the necessity of your attending.

Accompanying this article will be seen the pictures of a few of those who will address the convention. We hope that by the date of publication of the December issue we will be able to include in that number many additional ones. The following brief comments relative to these speakers should be of interest.

The address of welcome which will be presented at the opening of the convention on Monday morning will be made by the Honorable Victor J. Miller, Mayor of the City of St. Louis. To many of us Mayor Miller needs no introduction for he has addressed the St. Louis Quarrymen's Association on previous occasions. Mayor Miller studied engineering at the University of Missouri and later graduated in law from Washington University in St. Louis. He began his practice of law in that city in 1911. His first public office was that of President, Board of Police Commissioners, City of St. Louis. He was elected mayor of St. Louis in April, 1925, and re-elected for a second term of four years in April, 1929. It is the exception rather than the rule for the administrative head of the city to be as thoroughly familiar with our problems as is Mayor Miller. It is therefore with particular pleasure that we are looking forward to hearing from him at the opening session of the convention.

From a domestic as well as a business point of view the talk on "How to Win an Argument" should be of interest to all of us. Professors Alvin C. Busse and E. E. Nyberg of New York University, will present this subject in dialogue in a most unique and entertaining manner. Professor Busse is a graduate of McAlester College, St. Paul, Minnesota, having received a scholarship to that institution. In 1921 he began his teaching career at New York University, New York City, and also at about that time began his studies in research in the field of salesmanship. He was engaged in research work in 1928 and 1929 for the Hearst newspapers. He was also advisor on promotion work for the New York Evening Journal and is at present Director of Public Relations at New York University.

Assuredly no crushed stone producer who has been present at any of the last few of our annual meetings needs an introduction to J. V. Neubert, Chief Engineer, Maintenance of Way, New York Central Railroad Company. Mr. Neubert has been a frequent and always most welcome addition to our program and his many friends throughout our industry will be more than gratified to learn that he will be with us again in St. Louis. His talk entitled, "What Factors Control the Service Factors of Ballast?" is a particularly timely one and we are looking forward with pleasure to hearing from Mr. Neubert.

The session devoted to sales problems will be privileged to hear Robert J. Kratky of St. Louis, speak on the subject, "Popularizing an Industry." Mr. Kratky is an Attorney at Law of note in St. Louis, having graduated from the Benton College of Law. For twenty years he has been actively identified with industrial, civic and political organization work in Missouri. In addition to belonging to the St. Louis Bar Association, he is a member of the Missouri Bar Association and the American Bar Association.

It is again a very real pleasure to be able to include on our program Charles M. Upham, Engineer-Director of the American Road Builders' Association, who will speak on a subject which is rapidly becoming of increasing importance entitled, "The Secondary Road Problem." As is the case with Mr. Neubert, Mr. Upham needs no introduction to crushed stone producers, having given us the pleasure and profit of hearing from him on many occasions in the past. We feel deeply indebted to Mr. Upham for consenting to speak to us again this year, particularly in view of the exceptional demands which must be made upon his time in connection with his own convention which it will be recalled is to take place in St. Louis during the week immediately preceding our own.

CHARLES M. UPHAM

Tentative Program St. Louis Convention
January 19, 20, 21 and 22, 1931

(This Program is Tentative Only and Subject to Modification)

MONDAY, JANUARY 19

MORNING SESSION

W. F. Wise, President, Presiding

10:00—Address of Welcome—Hon. Victor J. Miller, Mayor, City of St. Louis.

10:15—Response for the Association—W. R. Sanborn, Lehigh Stone Co., Kankakee, Ill.

10:25—Presidential Address—W. F. Wise.

10:40—Reports of Directors on Business Conditions in 1930 and Outlook for 1931.

12:00—Appointment of Convention Committees:
- Resolutions
- Nominating
- Finance
- Auditing
- Reception
- Publicity
- Constitution and By-laws

12:20—Report of Committee on Finance—A. L. Worthen, Chairman.

12:30—Adjournment.

1:00 to 2:00 P. M.—Greeting Luncheon—Everyone, including active and associate members, as well as guests, is cordially invited to attend.

Col. O. P. Chamberlain, President, Dolese & Shepard Co., Presiding.

Luncheon Address—(Speaker to be announced later).

MONDAY, JANUARY 19

AFTERNOON SESSION

Arthur S. Lane, John S. Lane & Son, Inc., Meriden, Conn., Presiding

2:30—Report of Membership Committee—J. R. Boyd, Chairman.

2:40—Some Legal Aspects of Proration—Harold Williams, Member of the Boston Bar.

3:00—General Discussion.

3:10—The Economic Features of the Bituminous Type of Road—B. E. Gray, Highway Engineer, The Asphalt Institute.

3:30—Discussion—C. L. McKesson, Director of Engineering and Research, American Bitumuls Co.

3:40—Discussion—George E. Martin, Consulting Engineer, The Barrett Company, New York, N. Y.

3:50—Taxation and Transportation—Dr. Wm. B. Guitteau, formerly Executive Secretary, Ohio Crushed Stone Association.

4:10—General Discussion.

4:15—Report of Committee on Standards—F. S. Jones, Chairman.

Sub-committee for the Standardization of Commercial Sizes of Crushed Stone—A. T. Goldbeck, Chairman.

Sub-committee for the Standardization of Drilling Equipment—W. W. Duff, Chairman.

Sub-committee for the Standardization of Specifications and the Marking of Supplies and Equipment—John Rice, Jr., Chairman.

4:50—General Discussion.

5:00—Adjournment.

MONDAY EVENING

7:30—Formal Opening of Manufacturers' Division Exposition of Quarry Equipment, Machinery and Supplies—Mezzanine Floor, Hotel Jefferson.

TUESDAY, JANUARY 20

MORNING SESSION

A. L. Worthen, Connecticut Quarries Co., Inc., New Haven, Conn., Presiding

10:00—The Applicability of Various Methods for Sewage Disposal—S. W. Freese, Hawley, Freese and Nichols, Fort Worth, Texas.

10:15—Discussion—Led by Prof. Harry N. Lendall, Head of Civil Engineering Department, Rutgers University, New Brunswick, N. J.

10:25—Rates and Rate Making—Edwin C. Brooker, Commerce Counsel, Washington, D. C.

10:40—Discussion.

10:50—Report of the Committee on Interpretation of Trade Practice Rules—O. M. Graves, Chairman.
11:00—Discussion.
11:05—What Is the Construction Outlook?—Thomas S. Holden, Vice-President, F. W. Dodge Corporation, New York City.
11:20—How to Win an Argument—Professors Alvin C. Busse and E. E. Nyberg, New York University.
12:05—Report of Auditing Committee.
12:10—Report of Finance Committee.
12:20—General Business.
12:30—Adjournment.

TUESDAY AFTERNOON

Luncheons and Group Meetings

Luncheon

1:00 to 2:00 P. M.—Luncheon will be served on the Mezzanine Floor for Executives, Superintendents and Operating Men and others wishing to avail themselves of the opportunity of conferring with manufacturers of machinery, equipment and supplies. The program for Tuesday afternoon has been especially arranged to give all operating men a good opportunity to view in detail the Manufacturers' Division Exposition.

Meeting of Cost Accountants

L. R. Cartwright, Mid-West Rock Products Corp., Indianapolis, Ind., Presiding.

1:15—Luncheon.
2:00—Discussion of Proposed Uniform Cost Accounting Manual—Led by J. R. Thoenen, U. S. Bureau of Mines.

Sales Problems

P. B. Reinhold, Reinhold and Co., Pittsburgh, Pa., Presiding

1:15—Luncheon.
2:00—Popularizing an Industry—Robert J. Kratky, Attorney at Law, St. Louis.
2:30—Discussion.
2:40—Development and Carrying Out of a Sales Program Through Central Office Control—E. T. Nettleton, Sales Manager, The Connecticut Quarries Co., Inc., New Haven, Conn.
3:00—The Management of Credit in the Stone Industry—Wm. E. Hilliard, Gen. Mgr., The New Haven Trap Rock Co., New Haven, Conn.
3:15—Discussion.
3:25—What Can a Local Trade Association Do to Ethically Promote Sales?—Col. E. J. McMahon, Executive Secretary, St. Louis Quarrymen's Association, St. Louis, Mo.
3:50—General Discussion.
4:30—Adjournment.

TUESDAY EVENING—SAINT LOUIS NIGHT

WEDNESDAY, JANUARY 21

Morning Session

W. R. Sanborn, Lehigh Stone Company, Kankakee, Ill., Presiding

10:00—Ready Mixed Concrete—H. F. Thomson, Vice-President, National Ready Mixed Concrete Association, General Materials Corp., St. Louis.
10:15—Discussion.
10:25—Researches in the Durability of Concrete—Harry Gonnerman, Manager, Research Laboratory, Portland Cement Association, Chicago, Ill.
10:40—Researches of the National Crushed Stone Association—A. T. Goldbeck, Director, Bureau of Engineering, Nat'l Crushed Stone Association.
11:00—Discussion of Two Preceding Papers.
11:10—Responsibility of the Aggregate Producer as Viewed by the Engineer—E. R. Kinsey, President, Board of Public Service, St. Louis, Mo.
11:25—Discussion.
11:30—What Factors Control the Service Value of Ballast?—J. V. Neubert, Chief Engineer, Maintenance of Way, New York Central Railroad Co.
11:45—Discussion—Report of Committee on Ballast—H. E. Bair, Chairman.
11:55—Report of Committee on Uniform Cost Accounting—L. R. Cartwright, Mid-West Rock Products Corp., Indianapolis, Ind., Chairman.
12:05—Discussion.
12:15—Report of Committee on Resolutions.
12:25—Report of Committee on Constitution and By-Laws.
12:30—Report of the Nominating Committee and Election of Officers.
12:45—Greeting of President-Elect.
1:00—Adjournment.

WEDNESDAY, JANUARY 21

AFTERNOON SESSION

General Session for Everyone, but Arranged especially for

Operating Men, Superintendents and Manufacturers

Wm. M. Andrews, Lake Erie Limestone Co., Youngstown, Ohio, Presiding.

1:15—Luncheon.

2:00—Crusher Bearings—Their Troubles and Remedies—L. D. Staplin, Carbonite Metal Co., Ltd., Chicago, Ill.

2:30—Discussion.

2:40—The Prevention of Segregation and Breakage in Bins—Major Henry Adams, Plainfield, N. J.

3:00—Discussion.

3:10—The Use of Electricity in the Handling of Stone—J. E. Borland, Engineer, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

3:50—Discussion.

4:00—Report of Committee on Accident Prevention—A. L. Worthen, Chairman.

4:10—Discussion.

4:20—Presentation of National Crushed Stone Association Safety Trophy—W. W. Adams, U. S. Bureau of Mines, Washington, D. C.

4:30—Adjournment.

Meeting of National Agricultural Limestone Products Association (Program to be announced later).

WEDNESDAY EVENING

ANNUAL BANQUET

Ball Room—Hotel Jefferson

7:30 P. M.

Toastmaster—Otho M. Graves, The General Crushed Stone Co., Easton, Pa.

Count Anton Carlson, President of the Sweden-Norway Crushed Stone Association

"Civics for the Civilized"—John B. Kennedy, Associate Editor, Collier's Weekly.

(Additional Speakers to be announced later).

THURSDAY, JANUARY 22

MORNING SESSION

W. F. Wise, President, Presiding

10:00—The Control of Accidents—T. J. Quigley, Chief, Mines and Quarries Section, Department of Labor and Industry, Pennsylvania.

10:30—The Secondary Road Problem—Chas. M. Upham, Engineer-Director, American Road Builders' Association.

11:00—Mental Self Discipline Aids in Industry—Dr. H. S. Hulbert, Psychiatrist, Chicago, Ill.

11:45—General Business.

12:00—Installation of Officers.

Ladies' Entertainment Program

All arrangements to be in charge of the Ladies' Entertainment Committee assisted by hostess to be supplied by St. Louis Convention Bureau.

MONDAY, JANUARY 19

10:00—Registration.

3:30—Reception and Tea in Ladies' Headquarters.

8:00—Theatre Party.

TUESDAY, JANUARY 20

1:00—Luncheon—followed by Card Party.

8:00—St. Louis Night.

WEDNESDAY, JANUARY 21

2:00—Sightseeing Trip, including visit to Art Museum, Zoo, Shaw's Garden, Lindbergh Trophies, returning to Jefferson Hotel at 5:00 P. M.

7:30—Annual Banquet.

THURSDAY, JANUARY 22

12:00—Luncheon—Hotel Jefferson.

American Road Builders' Association Will Also Meet in St. Louis

THE annual convention and Road Show of the American Road Builders' Association will be held in St. Louis during the week of January 12 and no doubt many crushed stone producers will find it convenient to arrive in St. Louis three or four days preceding our annual meeting so that they may have an opportunity of visiting what is generally conceded to be the largest exposition of equipment and machinery used in the highway industry held anywhere at any time throughout the year. Arrangements have been made with the railroads whereby reduced rates will be in effect covering the American Road Builders' Association Convention as well as the National Crushed Stone Association Convention and the National Sand and Gravel Association Convention which takes place during the week following our own meeting. The arrangements this year provide that tickets may be purchased as early as January 4, having for their final return limit February 2, thus permitting those desiring to do so to attend all three of these meetings and still obtain reduced rates.

Types and Characteristics of Emulsions for Asphalt Paving Purposes[1]

By Lester Kirschbraun
Vice President In Charge of Research, The Flintkote Company

THE petroleum and asphalt industries long have been in close contact with that system of colloidal chemistry known as an emulsion.

Definition of Emulsion

For our purposes, we may define an emulsion as a heterogeneous system containing two normally immiscible liquid phases, one of which is dispersed as fine droplets or globules in the other. The inner phase, or the liquid which is broken up into the fine droplets, is known as the "dispersed phase," and the other liquid throughout which the droplets are distributed is known as the "continuous phase."

In dealing with dispersions in which one of the phases is asphalt, we can consider asphalt as a liquid of high viscosity, even though common parlance and arbitrary standards set up in the industry, segregate asphalts according to hardness, as solid, semi-solid and liquid. The term emulsion therefore is used with asphalt in this broad sense.

Types of Emulsions

With any two liquids, such as oil and water, there are two types of emulsion possible. When water is the continuous phase, the emulsion is called the oil-in-water type. When oil is the continuous phase, and water is distributed throughout the oil, the emulsion is termed the water-in-oil type.

Industrially, both types of emulsion are important. They may be found in nature or they may be prepared artificially. Oil field emulsion, lubricating grease and butter, are water-in-oil emulsions. Milk and cod-liver oil exemplify naturally occurring and artificially prepared oil-in-water emulsions, respectively.

Temporary Emulsions

When, to a relatively larger amount of water there is added slowly, with vigorous agitation, a smaller amount of benzene, the drops of benzene appear dispersed throughout the water. This produces a two-phase emulsion which exists only temporarily, and when agitation ceases, the two layers separate completely and almost immediately.

Permanent Emulsions

To produce a more permanent emulsion, a third agent must be added to the two phases above described. This agent generally is a colloid capable of being adsorbed at the interfacial layers between the phases. By forming a protective film about the dispersed phase, the drops thus are prevented from coalescing after dispersion has occurred. Permanent emulsions are all three-phase systems in which the emulsifying agent, in the presence of the two liquid phases, functions so as to prevent the immediate coalescence of the dispersed phase. The emulsifying agent, in fact, forms an adsorbed protective film about the dispersed particles, and it is upon the nature of this film that the properties and usefulness of the emulsion largely depend.

Types of Emulsifying Agents and Resulting Emulsions

The emulsifying agents which may be employed in producing emulsions are generally of two types, although the distinction between these types is not very sharp in certain cases. We may group these substances as follows:

(a) Substances which lower the surface tension of one of the phases.

(b) Substances which affect the surface tension of the contained medium slightly, but which swell in contact with the medium in which it is peptized, and in relatively small concentration produce a plastic or viscous suspension.

As stated before, either type of emulsifying agent must be capable of being adsorbed at the interface and must be capable of being "wet" by one, or by both,

[1] Reprinted from Proceedings, The Association of Asphalt Paving Technologists, West Baden, October 30, 1930.

of the phases present. Soaps, sulphonated oils and saponaceous materials are typical of group (a), while starch, casein and certain colloidal oxides and clay-like minerals exemplify group (b).

Emulsifying agents of both groups may produce either water-in-oil or oil-in-water emulsions, depending, among other considerations, upon their individual chemical and physical properties, the concentration of phases and the manipulative condition under which the emulsion is formed. Thus an oil-in-water emulsion is obtained when agents of group (a) are employed, which are soluble in, and which lower the surface tension of, the water more than that of the oil. Sodium oleate, therefore, tends to produce an oil-in-water emulsion, while soaps of the polyvalent metals, such as copper or magnesium oleate, which are soluble in, and/or primarily wet with oil, ordinarily will produce a water-in-oil emulsion.

Those agents of group (b) which are wet by either phase, likewise may produce either type of emulsion, depending, among other factors, upon the concentration of the phases at the time of formation. By having all of the oil phase present and by introducing the aqueous phase in small increments, a water-in-oil emulsion will result, while, if the reverse manipulation is carried out, an oil-in-water emulsion is found. Thus it is possible sometimes for both types of emulsion, of identical composition, to exist.

Properties of Oil-in-Water Emulsions

Limiting our discussion for the moment only to asphalt-in-water types of emulsion, it may be observed that, from the emulsifying agents classified above, there result emulsions of two general types:

(1) Emulsions which coalesce prior to dehydration.

(2) Emulsions which must dehydrate prior to coalescence.

The first type of emulsion generally "sets," or breaks, more readily than the second. It is very sensitive to the introduction of foreign substances, particularly to electrolytes, which precipitate the emulsifying agent, and to admixtures with mineral powders, or to any change brought about in the nature of the electric charge upon the particles.

The second type of emulsion generally "sets" more slowly than the first. It is more stable than the first and will permit incorporation of a greater or lesser variety of electrolytes and of substances of other types, depending upon the specific agent used. The great variation in properties of the above two types of asphalt-in-water emulsions, lends itself to widely different fields of industrial uses.

Role of Research in Perfecting Emulsions

It does not seem necessary in this paper to discuss further theories of emulsification. Suffice it to say that in the last decade or two the science of colloid chemistry has made great advances in the study and understanding of emulsions.

Knowledge, thus developed, of various properties and behaviors which may be imparted to, or brought about in emulsion systems is opening an ever-widening field of research and application in industry. Technically and commercially great progress has been made, so that the preparation, modification and use of emulsified asphalt in various branches of industry, including paving, is becoming of increasing importance.

Emulsion as Related to the Paving Industry

In the paving industry we are concerned primarily with oil-in-water emulsions. Specifically we will discuss permanent emulsions in which asphalt of suitable consistency or penetration, may be used in an aqueous medium as a road binder or cement. In connection with this industry we may limit further our field of inquiry to that type of emulsion which coalesces without complete dehydration, or which "sets" comparatively quickly.

This type of emulsion generally is prepared with the aid of emulsifying agents which are included in type (a) previously described. Specifically, they may be mono-valent soaps of the higher fatty acids, resin soaps, or soaps of sulphonated oils. In some cases the asphalts themselves contain acid constituents (probably napthenic acid) which require only the addition of suitable concentrations of alkali in the aqueous phase to effect emulsification. The latter emulsions, however, seldom are sufficiently permanent for transportation and storage, and require the subsequent addition of protective colloids or extraneously prepared emulsifying agents for their further stabilization.

Mechanical Technique of Preparation

Inasmuch as the soap type of emulsion is made with an agent which functions to lower the surface tension of the water phase considerably, the preparation, from a mechanical standpoint, is relatively simple. This involves vigorous mechanical agitation while the

phases are both freely liquid. This may be provided by means of paddle mixers, centrifugal pumps and similar agitating devices. A more recent development in preparation technique, involves the use of colloid mills of various types. This type of mill, with rotating discs operating at exceedingly high peripheral velocity, develops a shearing effect within the liquid film that effectively and rapidly produces dispersion.

While the preparation of an emulsion is relatively simple from a broad viewpoint, great variation in properties and in usefulness will result, even in using the same emulsifying agent. Many factors influence the product in this direction, among which may be mentioned temperature, concentration of phases with respect to each other, character of the asphalt employed, presence of specific ions, concentration of such ions and the nature of mechanical action to which the system is subjected. All of these, as well as other factors, influence the properties of the end product and must be understood and controlled in order to produce an emulsion of uniformity and of predetermined characteristics. It is a rather anomolous situation that the same apparatus which will make an emulsion, frequently will break it.

Improvement in Manufacturing and Application

It might be well to point out here that emulsified asphalts have been used continuously in the United States for periods as long as fifteen to twenty years. Pavements laid in the early days frequently gave good results, but more often, possibly, the results were erratic and uncertain. As with many other paving materials, such results merely serve to indicate lack of control and knowledge of the essentials in the preparation of the material, or unsatisfactory technique of use and application.

Through the development and the application of colloid chemistry to this art, it is believed that the former difficulties definitely have been overcome. Likewise, paving engineers have perfected application technique to a point at which it is believed that a wide usefulness for asphalt emulsion in the paving field is about to be realized in the United States.

Specific Properties of Emulsions

Reverting again to our discussion of theories of emulsification, it is apparent that the properties of an emulsion useful for paving purposes, will depend largely upon the nature of the film protecting the dispersed particles. Workers in the field, by applying the principles discussed above, have developed and controlled the properties of these emulsions so as to adapt them to specific uses. It may be well, however, to enumerate some of the characteristics necessary for a successful paving emulsion.

(1) It should contain asphalt of penetration, ductility, cementing value and other characteristics normally suited to the type of use contemplated.
(2) It must have bulk stability. That is, it must not be broken down by long periods of storage, or upon agitation during transportation.
(3) It must have sufficiently fine particle size so as freely to be suspendable.
(4) It must have a controlled degree of stability as a system, so that it will not break prematurely when sprayed or when mixed with mineral aggregates, inert mineral powders or with diluting water.
(5) Its time of coalescence, or "rate of break," must be suitable to the conditions for which it is to be used. In other words, it should break when deposited upon the road in the shortest time, compatible with its other stability requirements.
(6) Its viscosity must be definite, constant and suited to the purpose for which it is to be employed.
(7) It must have a concentration of asphalt which does not vary for the particular use for which it is intended.
(8) The relation between asphalt concentration and viscosity should be such that a regulated and predetermined film thickness is always deposited.
(9) The concentration of the emulsifying agent should be a minimum and always less than that which would in any way modify the properties of the asphalt binder.

Asphalt emulsions are now being manufactured both in the United States and abroad in which the above enumerated characteristics are controlled and adapted for certain specific construction types.

Successful Use of Asphalt Emulsion

European engineers have developed a road construction technique which, co-ordinated with the production of emulsified asphalt adapted thereto, has resulted in the building of tremendous mileages of roads,

(*Continued on page* 24)

C. M. Doolittle, Canadian Regional Vice-President, Receives Unusual Honor

C. M. DOOLITTLE

WHAT we believe to be unique in the experience of the members of the Association is to ship stone across the Atlantic Ocean for use in construction on the other side and our first member to achieve such a distinction is C. M. Doolittle, Canadian Regional Vice-President and member of the Executive Committee who has long been an active and ardent supporter of the Association and its work.

The new Ontario Provincial Building erected at 163-164 Strand, London, was constructed of building stone quarried at Queenston, Ontario, by Queenston Quarries, Ltd., of which Mr. Doolittle is President and principal owner and for which Canada Crushed Stone Corporation acts as distributor. The stone for the Ontario Building was transported to England in large blocks and the fabricating was accomplished there. Mr. Doolittle is to be congratulated upon the successful completion of such an undertaking. The characteristics of the stone insure not only a present pleasing appearance, but a continuing and enduring beauty that will exemplify the prominent position Canada is destined to maintain within the Empire. The accompanying photograph portrays the dignity and charm of the building erected by the Provincial Government of Ontario in the great metropolis as Ontario's headquarters at the Empire's capital.

The building was formally opened on October 21 by the Honorable G. Howard Ferguson, Premier of Ontario and the Honorable R. B. Bennett, Premier of Canada. Mr. Doolittle was invited to be present at the opening and crossed to England in the company of the Premiers and other Canadian representatives proceeding to the Empire Conference. His many friends throughout the Association will learn of the honor which has thus come to him with very real pleasure and gratification.

The following comments by Mr. Doolittle on his return should be of decided interest.

"The experience was particularly interesting and one felt that he was closely associated with the making of history.

"The tragic wreck of the R101 and the consequent long list of fatalities of prominent individuals somewhat marred the proceedings; the funeral of the victims was a sight never to be forgotten,—a spectacle so dignified and impressive as to make an indelible impression. The ceremonial of the British troops was faultless and the attitude of the immense throngs was one of sincere sorrow and distress.

"That the Premier of Canada at the Conference was a surprise to the British, must be admitted by all, irrespective of their political affiliations. He commanded respect and admiration for the fearless manner in which he stated his case, and while it would seem that the immediate accomplishment is inconsiderable, it is more than probable that the ultimate outcome will be along the lines of his recommendations.

"A close contact with the English man of large affairs cannot but impress one with his indomitable courage to carry on through the greatest difficulties. If they experience disappointment they do not demonstrate it, except by a greater effort. They seem to possess a reserve force and a supreme confidence that would lead one to believe in their final arrival.

"London possesses elements of the greatest interest to any intelligent observer. To a Canadian, it inspires a satisfaction and pride that is difficult to analyze. Undoubtedly, the background of historical romance and tradition is responsible for that reaction to a great extent; but viewing past accomplishment, one cannot but have faith in the future of this great people."

Queenston Quarries were taken over by the present owners some five years ago. Very considerable sums have been expended in improvement of property,

equipment and practice. The deposit of good stone has been proved to be practically inexhaustible; certainly for many generations to come. The capacity has been enlarged so that the requirements of the largest undertakings can be served. The popularity of the product is daily becoming enhanced. The Ontario Building in London is but an incident in the history of an industry that undoubtedly will become one of the outstanding operations in Canada and the Continent.

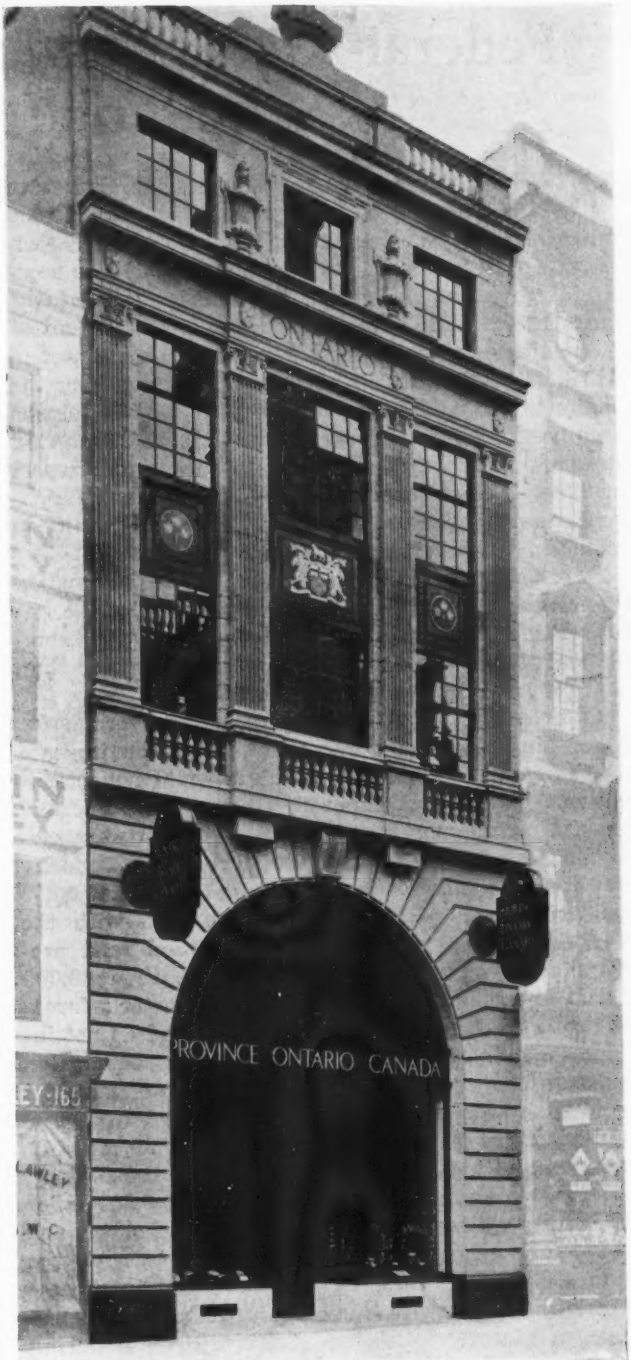
Gasoline Taxes $230,600,455 for First Six Months of 1930

THE 48 States and the District of Columbia collected an average tax of 3.39 cents a gallon on 6,809,863,076 gallons of gasoline during the first six months of 1930, according to reports received and compiled by the Bureau of Public Roads of the U. S. Department of Agriculture. After deducting certain exemptions from the total assessed tax, the net tax on the sales of gasoline amounts to $230,600,455. Under the tax laws, certain special fees, amounting to $381,644, also were collected, making a total of $230,982,099.

Based on the ratio of the number of gallons taxed in the first six months of 1929 to that year's total, and on the figures for the first six months of 1930, the amount of gasoline likely to be taxed for the current year is estimated by the bureau at 15,400,000,000 gallons. Figuring the taxes on the same basis and allowing for changes in tax rate, the total for the calendar year 1930 is estimated at $515,000,000.

After deducting collection costs of $995,719 from the tax receipts for the first six months of 1930, the States distributed the remainder as follows: $157,390,770 for construction and maintenance of State roads and $44,894,169 for construction and maintenance of county roads; $14,868,154 to apply on State and county road bonds; and $12,833,287 for miscellaneous purposes, such as town and city streets, public schools, seawall protection of roads, inland waterways under State departments of commerce and navigation, and oyster conservation.

The highest tax per gallon paid was *6 cents*; the lowest, *2 cents*. The average tax of 3.39 cents a gallon was .17 of a cent more than the average of 3.22 for the calendar year 1929.



New Ontario Provincial Building, London, England, constructed of stone quarried by Queenston Quarries, Limited, Queenston, Ontario, and transported to England.

Federal-Aid Highway Construction to be Materially Increased

WHEN Congress, at the last session, increased the authorized appropriation of $75,000,000 for cooperative construction of highways in the Federal-aid system for 1931 to $125,000,000 and also named this sum as the authorizations for each of the years 1932 and 1933, and when the apportionment of the additional sum for 1931 was made to the States in April, they immediately responded by increasing the allotments to definite projects to $102,498,084 for the fiscal year 1930, as compared with $70,428,896 during the fiscal year 1929, according to the annual report of Thos. H. MacDonald, Chief of the Bureau of Public Roads which Secretary of Agriculture Hyde made public in Washington recently.

"This higher rate of obligation will be followed in due course by a greater rate of completion of the improvements now undertaken and the next year's completion of projects should be materially greater than that reported for this year," says the report.

Commenting upon the increased authorization for 1931, Mr. MacDonald commented that the increase had an immediate effect upon the unemployment situation. The apportionment was made in April and in that month more than 4,000 more men were employed in road construction than in April, 1929. May and June also showed increased employment of 4,800 and 1,300 men respectively, as compared with the 1929 figures. In August, the Federal-aid road program alone gave employment to more than 48,000 men. These figures represent the contractor's forces employed in the construction of roads, and do not include the employment of workmen in the preparation and transportation of the large quantities of material required by the enlarged program.

During the fiscal year, ending June 30, the 48 States and Hawaii, in cooperation with the Federal government, completed improvements on 9,349 miles of Federal-aid highways (which includes bridges and their approaches), says Mr. MacDonald. At the close of the year, these agencies also had in process of improvement with Federal funds another 9,915 miles of highways. Federal funds disbursed during the year on all active road and bridge projects amounted to $75,880,863, about $6,200,000 less than for 1929.

The mileage improved with Federal-aid in 1930 was lower than in any year since 1924. "The decline was anticipated," says the report, "and is the natural result of the contraction of the propram to a $75,000,000 basis, necessitated by the authorization of that annual sum for several years and the final absorption of the unobligated balance of funds appropriated for the earlier years." With the Federal-aid authorizations increased to $125,000,000 for each of the three ensuing years, a corresponding yearly increase in improved mileage over the 1930 figure is expected.

In the Federal-aid system, at the close of the year, there were 193,049 miles of main interstate and intercounty highways, of which a total of 84,012 had been improved with the aid of Federal funds.

During the year, the Bureau, with Federal funds, completed improvements of 266 miles of forest roads, bringing the total improved miles to 4,357. In this system of 14,576 miles of major forest highways are many that serve as approaches to national parks.

The Bureau also cooperates with the National Park Service in surveying and constructing roads in the national park system. In 1930, 88 miles were improved bringing the total improved miles to 302. The national park system includes 1,509 miles of major highways.

Construction of the Mount Vernon Memorial Highway, which the Bureau is building under congressional authority and appropriation, was well under way at the close of the year. The contract for riprap foundation seawall was completed; the hydraulic fill work was nearing completion; and satisfactory progress had been made in the grading and drainage and bridge work. The highway follows the Virginia shore of the Potomac River for 15½ miles from Columbia Island opposite the Lincoln Memorial in Washington, D. C., to Mount Vernon, Virginia. Bids for surfacing the highway will be requested some time after January 1, 1931.

During the year the Bureau continued its cooperation with a number of States in the restoration of roads damaged by the floods of 1927 and 1928. This work, made possible by several special acts of Congress, has resulted in the completion of improvements on 57 miles of highways in Vermont; 24 in New

Hampshire; 39 in Kentucky; and a short stretch in Mississippi.

The Bureau continued its program of highway research to produce a more exact factual basis for the design of road systems and road structure suited to the expanding needs of modern highway traffic.

"Of principal interest during the year," says the report, "were the survey of traffic on the Federal-aid system in the Western States, completed in October, 1930; the study of soils in respect to their usefulness and stability as road subgrades; the extensive studies and intensive experiments looking to the development of types of surface of low cost suitable for the large existing mileage of lightly traveled roads; the continuation of studies of the characteristics of concrete for road pavements and bridges; and the analyses of the possibilities of greater economy in construction operations which also have been continued with increasingly useful results."

Two simultaneous operations are being performed in each year's improvement of the Federal-aid system. The one extends the mileage of initially improved highways upon which no Federal funds have previously been spent; the other raises to higher types of construction the mileage already initially improved.

For convenience of comparison, the total improved Federal-aid mileage for the year is divided into three general types: high types which include bituminous macadam, bituminous concrete, Portland cement concrete, and block pavements; intermediate types which consist of treated macadam roads and low-cost bituminous mixed surfaces; and low types, which include untreated and bituminous-treated sand-clay, untreated and bituminous-treated gravel roads, and graded and drained earth roads.

Of the 7,317 miles initially improved during the year, 39 per cent carried high type surfacings; 3 per cent intermediate types, and 58 per cent low types. According to the report, the types, in general, were built in close accord with the demands of traffic, and the more resistant and hence more expensive improvements are found to the greater extent in those sections of the country where traffic is heaviest.

The Bureau, by taking the number of registered motor vehicles per mile of Federal-aid system in each geographic area as an appropriate index of the general density of traffic in the area, has established the relation of the types of initial improvements completed during the year and the general density of motor vehicle traffic on the Federal-aid highway system.

In the Middle Atlantic, New England, and East North Central States where traffic is dense, and where the number of motor vehicles per Federal-aid mile are 395,268 and 230 respectively, the percentages of high type surfaces initially improved during the year were found to be 90, 87, and 84 per cent respectively; the percentages of low types, 10, 3, and 16 per cent respectively. The New England group also showed 10 per cent improved with intermediate types.

In the Pacific States, which have been active in the development of the low-cost bituminous mixed surfaces, and where the number of motor vehicles per Federal-aid mile was 240, the percentages of high type surfaces was 25 per cent, of intermediate types 20 per cent, and of low types 55 per cent.

In the South Atlantic, West South Central, East South Central, West North Central, and Mountain States, where the number of vehicles per mile was 107, 97, 83, 75, and 40 respectively, the percentages of high types were 61, 28, 23, 15, and 3 per cent respectively and the low types mounted to 36, 72, 77, 82, and 91 per cent respectively. The South Atlantic and West North Central each show 3 per cent of intermediate types of surfacings, and the Mountain States 6 per cent.

The effect of stage construction is shown in the report by a comparison of the percentage of net increase in mileage by types and the percentage of initially improved mileage by types. While the high type mileage initially improved during the year constituted only 39 per cent of the total mileage so improved, the net increase in high types was 61 per cent, exclusive of bridges. The intermediate types which formed only 3 per cent of the year's initial improvements constituted 9 per cent of the net increase in mileage; and the lower types which made up 58 per cent of the initially improved mileage were only 30 per cent of the net increase in mileage. Graded and drained earth roads which constituted 35 per cent of the initially improved mileage formed only 17 per cent of the net increase in mileage.

A review of the mileage of the several types of Federal-aid roads improved at the close of the fiscal years 1929 and 1930 and of the percentage of change, shows an increase in high type pavement of 13 per cent, in low types of almost 5 per cent, and a general increase of more than 7 per cent.

Included in the year's total of 9,349 miles of improved Federal-aid highways are 46 miles of bridges and their approaches, which brings the total length of Federal-aid bridges and bridge approaches in use at the end of the year to 332 miles.

The Crushed Stone Journal

Official Monthly Publication of the
NATIONAL CRUSHED STONE ASSOCIATION, INC.
Merchandise Building 1735 Fourteenth St., N. W.
WASHINGTON, D. C.

J. R. BOYD, Editor

Iowa Aggregate Producers Oppose Reduction in Wage Scale

IN times past whenever the country was unfortunate enough to find itself in the throes of a business depression, prevailing opinion seemed to be that the quickest answer to the problem was a general reduction in the wage scale which inevitably resulted in making a bad situation worse, to say nothing of the attendant suffering and hardship. It is most fortunate that the fallacy of this solution has gradually been demonstrated by bitter experience to the satisfaction of the foremost business men of the country, until today it seems to be pretty generally held that in the face of all odds the wage scale should be maintained. Tangible proof of this fact exists in the questionnaire sent out earlier in the year by *Printers' Ink* to many of the leading corporations of the country asking for an expression of opinion on this subject, and it is a most creditable reflection upon American industry that by far the majority of replies were emphatically in favor of maintaining the present wage scale.

It is particularly gratifying to learn that a substantial unit of the crushed stone industry, as represented by the Iowa Aggregate Producers Association, has publicly declared itself in favor of continuing the present wage scale, when in a recent meeting they passed the following resolution:

"We, the producers of Crushed Stone, Gravel and Sand, represented by the Iowa Aggregate Producers Association, as employers of a large amount of labor, endorse the general policy of President Hoover in his appeal to employers to maintain a wage scale in 1931 equally as good as 1930.

"We commend other employers who endorse this same policy, as we sincerely believe that only by maintaining a living wage to labor can we expect an early return to normal conditions."

Such action in the face of present conditions is highly commendable and predicated as it is on sound business judgment should be quickly recognized and followed by producers throughout the entire country.

Modern Industry Needs the Trade Association

EVEN today when there are but few who will not recognize the fact that the trade association plays a most important and necessary part in modern business and the economic structure of the country, we still occasionally hear the comment made, "I do not believe in associations." Not long ago Stephen I. Miller, Executive Manager of the National Association of Credit Men, was present when a prominent business man gave utterance to such an opinion. Mr. Miller's remarks in reply to this statement should be of particular interest and we quote the following which appeared in his General Letter No. 4 to his members:

"A few days ago a very prominent business man said to me:

> 'I do not believe in Associations—Associations are too much like governments. I do not believe Associations can function as efficiently in the business field as business organizations operating fror profit.'

"If my friend means by this statement that business on the whole can be better conducted by indi-

viduals than by governments it will be accepted by most people now in the United States. If, on the other hand, he means that there is no room for associated or co-operative activity it is entirely a different question. The modern business world, based on the theory of individualism and competition, has found it necessary to modify these fundamental principles in many important respects. Super-individualism has wasted a large percentage of our natural resources and is now busy in some basic industries exhausting the product and selling it at a loss; excessive competition between business units has driven thousands and tens of thousands into bankruptcy. Finally, undue emphasis of individualism has led, quite logically, to over-specialization along many lines of economic activity. It is true that the American emphasis of the individual has brought out splendid leadership, stimulated invention and advanced business administration.

"That we have gone too far in competition and individualism has too frequently been emphatically brought to our attention. The present economic depression is the result of a failure to observe certain business indices. These very indices have been the result of governmental and co-operative association effort. Excessive competition among producers has accounted for overproduction along innumerable lines leading direct to the difficulties that now confront us.

"Practically all business standards are the result of Association activities. The development of greater ethics in business is largely the result of co-operative endeavors. Credit information has resulted from the power of Credit Men to organize themselves into the National Association of Credit Men. The spirit of unity built up by the formation of associations has been no small thing in the progress of our country. There may be overlapping and even excessive organization along some lines; nevertheless, specific contributions have been the result. There is scarcely a trade in the United States that is not reaping advantages from co-operation. Sometimes these results take the form of better collections or the elimination of fly-by-night competitors. As a matter of fact, one of the most potent forces in American life today has been the confidence, the organization, the association which has made it possible for men to drop their extreme individualism and work together toward higher standards in their respective fields. We will not see less of this emphasis in the future, but I predict that the power of groups, acting through their associations or organizations, will be a very essential part of our economic progress."

Price-Cutting

AS sure as the sun rises each day, there are those in every industry who when confronted with severe competition seem to feel that price-cutting is a justifiable and economic solution. This is particularly true, or at least we have more illustrations of it, in times of depression. Herbert N. Casson briefly but pointedly characterized the price-cutter in comments which he originally made in the *Standard Oil Bulletin* of October, 1914. His article was recently reprinted in the *Standard Oil Bulletin* and his remarks are so timely as to warrant publication in this column.

"The price-cutter," says Mr. Casson, "is worse than a criminal. He is a fool. He not only pulls down the standing of his goods; he not only pulls down his competitors; he pulls down himself and his whole trade. He scuttles the ship in which he himself is afloat. Nothing is so easy as to cut prices; and nothing is so hard as to get them back when once they have been pulled down. Any child can throw a glass of water on the floor, but all the wisest scientists in the world can't pick that water up. Who gets the benefit of price-cutting? Nobody. The man who sells makes no net profit; and the man who buys soon finds himself getting an inferior article. No manufacturer can permanently keep up the standard of his goods if the price is persistently cut. Pretty soon he is compelled to use cheaper materials, and to cut down the wages of his workers. The man who cuts prices puts up the sign: 'This way to the junk-heap.' He admits his own failure as a salesman. He admits he has been defeated according to the Marquis of Queensbury rules of business. He admits he can not win by fighting fair. He brands himself as a hitter-below-the-belt. If the business world were dominated by price-cutters, there would be no business at all. Price-cutting, in fact, is not business any more than smallpox is health. Whenever you see this sign on a price-cutter's store—'Going Out of Business'—you may be sure it is a lie. How can he go out of business when he never was IN?"

ALL crushed stone producers of the United States and Canada whether or not they are members of the National Crushed Stone Association, are most cordially invited to be present at the Fourteenth Annual Convention of the crushed stone industry to be held at the Hotel Jefferson in St. Louis, January 19-22, 1931. If you have not already done so, be sure to make your reservations with the Jefferson immediately, as only in this way can you be assured of obtaining just the accommodations desired.

Labor Exceeds Half Pavement Building Cost

BY E. E. DUFFY

HOW much of the highway dollar goes to labor? According to the calculations of Fred R. White, chief engineer of the Iowa Highway Commission, more than half of the money spent on hard surfaced road building goes directly to workmen.

During the last few weeks there has been considerable talk about the relief of the unemployment situation through extended road building activities. The Federal Government has speeded up the allotment of Federal Aid funds, making some $125,000,000 immediately available. But as yet only few states have made definite attempts to cooperate and still fewer have broadened road activities.

Road building as an outlet for unemployed men is not idle talk, nor is it theory. Considering the average paving job a force of from 40 to 60 men is needed, depending on the locality, for each paving outfit. In addition, considerable labor is needed for grading and bridge building. For laying a mile of pavement these men, together with the men who make the cement, handle the aggregate, make the reinforcing steel, do the freight handling, receive 52.34 per cent of the cost of the pavement. But calling to mind the men employed in making road machinery, labor actually receives considerably more.

From this it is readily seen that pavement building benefits workmen far afield from roads. It so happens that this country, with little more than 100,000 miles of roads, hard surfaced to the point of lowest car operating costs and lowest upkeep costs, is greatly in need of more pavements. Economists agree that whatever suffering is occuring to communities is not that of lack of resources or of money, but rather the lack of consumptive power on the part of workmen. Because of the dire need for pavements communities can both reestablish effective distribution of currency and equip themselves with much needed motoring facilities.

Taking into consideration the actual cash value of hard surfaced pavements, which save from one to two and a half cents a mile in car operating costs over less stable surfaces, and the lessened upkeep costs on the road itself, it is good business for communities to expand their pavement building as an economy measure as well as a social.

The outlay required for needed pavements, both city and rural, is frequently more than current income. Numberless communities, realizing they can build pavements that will long outlast the bonds, are adopting the bond issue method. Current motor vehicle tax returns easily pay the costs and no extra taxation is usually necessary.

Accidents in Quarrying Industry During 1929

A STATISTICAL survey of the quarrying industry in the country during the calendar year 1929, made by the United States Bureau of Mines, Department of Commerce, showed that 126 men were killed and 9,810 were injured in this branch of mineral industry. The death rate, for men employed both in and about the quarry and at outside works, was 1.65 per thousand 300-day workers, which was an increase of 13 per cent over 1928 when 119 men were killed. The injury rate of 128.14 decreased one per cent from the 1928 figure, which was based on 10,568 injuries.

Of a total of 85,561 men employed in quarries of various types, the largest group of workers was the 36,134 men at limestone plants; this was followed by 20,687 cement-rock workers; 11,195 at granite quarries; 6,658 at marble quarries; and 3,736 at sandstone and bluestone quarries; 3,599 at trap-rock quarries; and 3,552 at slate quarries. At limestone quarries 58 men were killed and 5,315 were injured, with resulting fatality and injury rates of 1.87 and 171.46. Twenty-six of the cement-rock workers were killed and 944 were injured, the fatality and injury rates being 1.20 and 43.48. In the granite group 23 men were killed and 1,515 were injured, with fatality and injury rates of 2.49 and 163.85 respectively. At marble quarries 5 men were killed by accidents and 609 were injured, the fatality and injury rates for this group being 0.79 and 95.62. In the sandstone and bluestone group 1 employee was killed and 343 were injured, with fatality and injury rates of 0.39 and 134.99. In the trap-rock quarries 11 men were killed and 592 were injured, resulting in a fatality rate of 4.07 and an injury rate of 218.93. Slate quarries, the smallest of the group in point of the number of employees, reported 2 men killed and 492 injured, with a fatality rate of 0.67 and an injury rate of 164.55.

All fatality and injury rates are based on 300-day, or full-time, workers. The number of days that quarry employees actually work varies from year to year and

(*Continued on page* 24)

Types and Characteristics of Emulsion for Asphalt Paving Purposes

(*Continued from page* 15)

both in England and upon the Continent. The types of application generally employed comprise the carpet coating of gravel and macadam roads, and the building up of new wearing surfaces by the so-called grouting method. This is similar generally to our penetration construction by means of hot application. This development in Europe has been stimulated probably largely through, (1), existence of already completed macadam roads useful for foundation purposes; (2), low initial cost of construction; (3), small investment in equipment; (4), ease of application with unskilled labor; (5), ability to carry on construction in wet weather, and (6), low cost of maintenance.

An interesting account of construction practise and inspection of emulsion roads may be found in a report to the California State Highway Department, by Mr. C. L. McKesson.

In addition there is being developed quite a widespread use of emulsified asphalt in connection with the curing of concrete roads. This treatment lends itself to many obvious advantages and well may bring about important advances in the surface treatment and maintenance of this type of construction.

There is no doubt that in this country an extended use of emulsified asphalt is coming about in connection with our secondary roads. Paving engineers are developing familiarity with this type of material. For certain classes of roads, including maintenance and new construction, emulsified asphalt is now finding an increasingly important place in America.

Accidents in Quarrying Industry During 1929

(*Continued from page* 22)

from State to State, hence the hazards of their occupation are not the same and accident rates based on the average number of employees as actually reported would not be comparable. By reducing the number to its equivalent of 300-day workers, the accident rates indicate more accurately the liability to accidents to which the employee is exposed.

Of the 126 deaths in the entire industry, 78 occurred in the quarries and 48 at outside works, while 6,173 injuries were caused by operations inside the quarries and the remaining 3,637 occurred on the outside.

The principal cause of death inside the quarries was falls or slides of rock or overburden, which accounted for 19 deaths. Explosives ranked next with 17 fatali-

(*Continued on page* 26)

Accidents in Quarrying Industry During 1929

(*Continued from page* 24)

ties, followed by 9 from haulage, 8 from falls of persons, 7 each from machinery and boiler and air-tank explosions, 3 rom electricity, and 2 each from handling rock at face and drilling and channeling. There was 1 death caused by falling objects and the causes of the remaining 3 fatalities were not designated. Handling rock at face was responsible for 24 per cent of the injuries inside the quarries; over 1,400 injuries of the 6,173 reported as occurring in and about the quarry, being reported under this head. In outside works haulage was responsible for 14 deaths; machinery for 13; falling objects for 5; falls of persons for 4; electricity for 3; burns for 2; flying objects and handling rock by hand for 1 each; and miscellaneous causes for 5. The greatest contributing factor to injuries at outside works was flying objects, which caused 641 injuries of the 3,637 reported.

Pennsylvania employed 14,478 men in the quarrying industry, the largest number employed in any State. Ohio followed with 5,978; Indiana with 5,407; Illinois with 4,381; California with 4,366; New York with 4,322; and Vermont with 4,148.

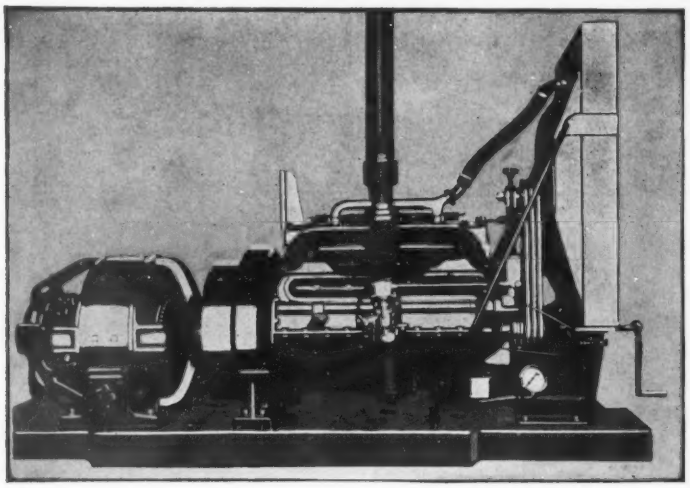
Additional Funds for Federal-Aid to be Asked of Congress

AUTHORIZATION for appropriation of as much money as the States can match for the construction of roads is proposed in a bill to be offered by Representative Dowell (Rep.), of Des Moines, Iowa, chairman of the House Committee on Roads, during the coming session, the chairman stated orally Nov. 26.

"A program of road-building can do much toward the relief of the unemployment," the chairman said, "and it is for the good of all concerned that such a program be undertaken. The farmers want good roads, and the merchants want good roads, and the merchants of such roads will give work to a great army of people. It is one of the best methods of accomplishing a good purpose and of distributing money for the relief of unemployed.

"It is estimated that of the money spent in the construction of highways 52 per cent goes for labor.

"The appropriations made last year for this purpose are available until July 1, 1931, and in case any of the States spend money they already have before that time it is my desire to have legislation enacted which will permit them to have appropriations to continue."



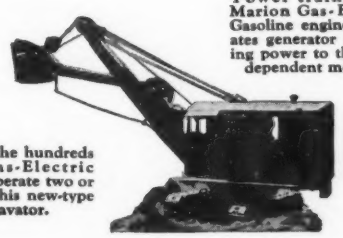
Can't Stall!

NO need to crank the gas engine on this shovel—it can't be stalled!

YOU can't overload the Marion Gas-Electric—even when the dipper hits a snag. Full protection against stalling is provided in the power train—a cushioning effect found only in the Type 450. Swing, hoist and crowd motions are from independent motors—not tied into a mass of clutches, gears, jack-shafts, etc. Hundreds of the 450 are already in use, proved the best on the market by eight years of tests and national performance. Find out for yourself—get in touch with a Marion man today!

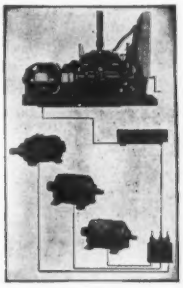
A SIZE FOR EVERY NEED

Type 450 - 1¼ yd. Steam, Electric, Gas-electric, Diesel-electric.
Type 32 - 1½ yd. Steam.
Type 460 - 1½ yd. Electric, Gas-electric.
Type 480 - 2 yd. Steam, Electric, Diesel-Electric
Type 490 - 2¼ yd. Electric.
Type 4120 - 3 yd. Electric.
Type 5120 - 3 yd. Electric.
Type 4160 - 4 yd. Electric.
Type 125 - 4 yd. Steam, Electric.
Type 5320 - 8 yd. Steam, Electric.
Type 5480 - 12 yd. Electric.



50% of the hundreds of 450 Gas-Electric owners operate two or more of this new-type excavator.

Power train of the Marion Gas-Electric. Gasoline engine operates generator supplying power to three independent motors.



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» CHIPS «

MacCaddis was very proud of his ability as a golfer, and he expected perfect service from his caddies. One day he missed a stroke and yelled at his caddie: "Confound you, boy, you made me miss that putt!"

"I didn't do nothin', sir," replied the frightened caddie.

"Yes, you did; it was all the fault of your hiccup."

"But I didn't hic-hiccup, sir."

"I know you didn't. It's the first time you've missed since we started, and I allowed for it, you idiot!"

—*De Laval Monthly*

* * * * * * * * *

Little Lucy had just returned from the children's party and had been called into the dining room to be exhibited before the dinner guests. "Tell the ladies what mama's little darling did at the party," urged the proud mother.

"I frowed up," said Lucy.—*Kreolite News.*

* * * * * * * * *

"Yassah", said old Link, "business very good. Done bought a pig fo' ten dollars, traded pig for barrer, barrer fo' calf, calf fo' a bicycle, and sol' de bicycle fo' ten dollars!"

"But yo' don' make nothin', Link!"

"Sho 'nough, but look at de business ah been doin'."

—*Montreal Star.*

* * * * * * * * *

COME ANYWAY

"Can't you come to the party Saturday night, Mandy?"

"Nope, can't do it, Andy. I's got a case of lumbago."

"Well dat don't make no difference; bring it wid you. Dem fools 'll drink anything."—*Exchange.*

Muriel Josephine F....., seventeen, has been missing since she left her mother's home at No. ..... 95th Street, Brooklyn, Wednesday, for one of her periodic visits to her father. Yesterday her mother, Mrs. Marie F....., distracted by the idea she may have been taken to California for a movie career, offered a reward of $50.00 if she is brought back alive and $100. if dead.—*The World.*

Worth the difference, probably.—*New Yorker.*

* * * * * * * * *

PASS THE MURADS

A tabloid newspaper offering $1.00 each for "embarrassing moment" letters received the following epistle:

"I work on an early night shift in a steel plant. I got home an hour early last night and there I found another man with my wife. I was very much embarrassed. Please send $2.00 as my wife was also embarrassed."

The editor, so we are told, sent a check for $3.00 admitting the possibility that the stranger, too, might have been embarrassed.—*Exchange.*

* * * * * * * * *

Classified advertisement in a Chicago newspaper: "Large and high-grade cemetery has opening for high-grade man of executive ability, permanent and very attractive proposition."—*Hardware Age.*

* * * * * * * * *

LONG-LOST SOUL-MATE

He: "You haven't said a word for twenty minutes."

She: "Well, I didn't have anything to say."

He: "Don't you ever say anything when you have nothing to say?"

She: "No."

He: "Well, then, will you be my wife?"

—*New Hampshire Highways.*

National Crushed Stone Association
Fourteenth Annual Convention

January 19, 20, 21 and 22, 1931
Hotel Jefferson
St. Louis, Missouri

●

Railroads Authorize Reduced Fares

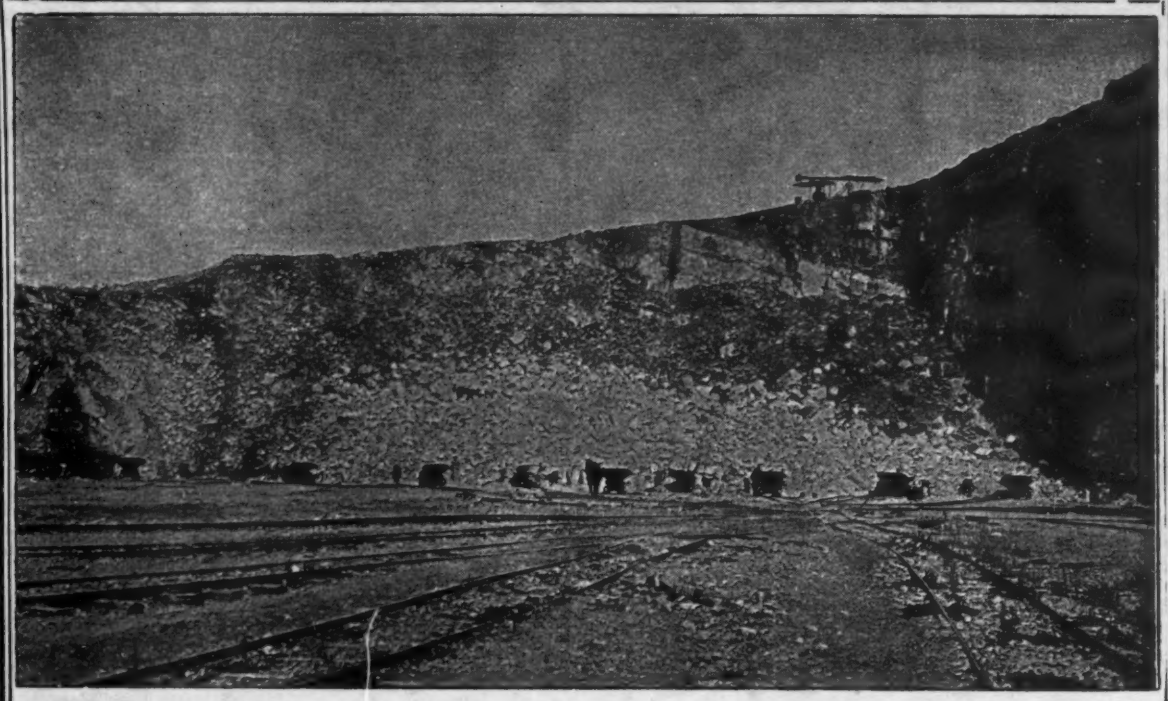
Important—Read Carefully

1. Reduced fare to St. Louis has been authorized under the Round Trip Identification Certificate Plan.
2. Upon presentation of certificate to ticket agent, delegate is entitled to purchase a round trip ticket to St. Louis for fare and one-half times the regular one way fare.
3. Certificates *will not* be available at offices of ticket agents, and can only be procured from the Secretary's Office in Washington.
4. Certificates are being mailed to all contemplating attendance at the Convention.

Have You Received Your Certificate?

If not, you should *immediately* communicate with J. R. Boyd, Secretary, National Crushed Stone Association, 1735 14th Street, N. W., Washington, D. C., requesting that one be sent to you.

5. Please help us to pass this information along as it would be regrettable if some of those attending the Convention were denied the privilege of obtaining reduced fare to St. Louis because they have failed to obtain a certificate.



CORDEAU Helps Improve the Fragmentation

CORDEAU, by speeding up the rate of detonation of the explosive charges in a blast, adds materially to the shattering effect of the explosive no matter whether it is a high grade dynamite or the slower blasting powders. Rock well broken, toe kicked out, little secondary blasting, and crushing units well supplied with rock mean good operating conditions and consequent profit for the quarry operator.

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